(19) FEDERAL REPUBLIC OF GERMANY

(Seal)

GERMAN PATENT AND TRADEMARK OFFICE

(12) **Disclosure Document**

(10) **DE 101 35 771 A 1**

(51) Int. Cl.[7]:
A 61 B 17/70
A 61 F 2/44

(21) File: 101 35 770.0
(22) Application Date: 7/23/2001
(43) Disclosure Date: 2/20/2003

(71) Applicant:

Aesculap AG & Co. KG, 78532 Tuttlingen, DE

(74) Representative:

Grießback and Colleagues, 70182 Stuttgart

(72) Inventor:

Stephan Eckhof, Dipl.-Ing. (FH), 78532 Tuttlingen, DE; Thomas Grupp, Dipl.-Ing. (FH), 73072 Donzdorf, DE; Susanne Schneid, Dipl.-Ing. (FH), 78532 Tuttlingen, DE: Michael Ogon, Dr. med., Innsbruck, AT

(56) Citations:

DE 33 10 833 C2
US 54 96 318 A
EP 07 43 045 A2
EP 06 46 353 A1
WO 99 40 866 A1
WO 00 53 126 A1

The following information has been obtained from the documents submitted by the applicant.

Examination petition pursuant to §44 PatG (German Patent Act) has been filed.

(54) Facet Joint Implant

(57) In order to facilitate the insertion of an implant in a joint space between two vertebral bodies when using a facet joint implant for the arthrodesis of a facet joint comprising a joint space and two facets, wherein the two facets comprise facet surfaces that face the other facet surface, respectively, it is being suggested that the at least one fixing element contain at least a first and a second surface and that the first and the second surfaces can be brought in areal contact with at least one facet.

Description

[0001] The invention relates to a facet joint implant for the arthrodesis of a facet joint comprising a joint space and two facets, wherein the two facets comprise facet surfaces facing the other facet surface, respectively, with at least one fixing element.

[0002] Typically motor segments of the vertebral column if needed are fused using bone grafts or so-called cages, wherein additionally dorsal fixation by means of internal fixation is provided, which stabilizes the fusion.

[0003] Another, relatively complicated possibility for dorsal fixation is the translaminar facet fixation by means of osteosynthesis screws according to Magerl.

[0004] Facet joint implants of the above-described kind are used in particular for the facet joint arthrodesis of ventral and/or trans- or extraforaminal vertebral body fusions, wherein the first one has an additive dorsal stabilizing effect.

[0005] Furthermore such implants are used for the treatment of spondylarthrosis with simultaneous hypomobility and severely reduced intervertebral space. Here the face joint implants are used alone, i.e. without using a ventral instrument system.

[0006] Known are for example facet joint implants produced from shape memory alloys as osteosynthesis clips, as they are disclosed especially in EP 0 646 353 A1 as well as in EP 0 743 045 A2. These clips have the disadvantage that the selected materials have to be subjected to thermal treatment intraoperatively in order to transfer the clip into the original shape, in which it can fix the facet joint.

[0007] Furthermore we know of staples from DE 33 10 833 C2, which comprise two legs connected via a crossbar, wherein they can be driven into a facet. Such staples in the inserted state have maximum stress in the area of the crossbar so that said web must be designed especially strong. Additionally this implant can easily deform.

[0008] It is therefore the object of the present invention to improve a facet joint implant of the above-described kind such that it can be inserted more easily in a joint space between two vertebral bodies.

[0009] This object is achieved with a facet joint implant of the above-described kind pursuant to the invention in that the at least one fixing element comprises at least a first and a second surface and that the first and the second surfaces can be brought into areal contact with at least one facet.

[0010] Such an implant can be inserted directly in the joint space and thus prevents directly movements of the two facets towards each other. Accordingly it can be designed especially torsion-resistant. Alternatively it is also possible to insert the fixing element transversely to the joint space in the two facets so that each surface has areal contact roughly half on or in the one facet and the other facet. In such a case then especially movements parallel to the joint space are fixed. Beyond that such a facet joint implant can be produced especially easily and inexpensively.

[0011] It is favorable when two fixing elements are provided and if one of the two fixing elements penetrates the other fixing element in a transverse direction. With

such a configuration a fixing element can be inserted directly in the joint space in order to prevent movement of the facets transversely to the joint space. The other fixing element is arranged transversely to the first fixing element and hence also transversely to the joint space so that it penetrates into the facets, for example in the form of two protruding tabs or wings, and prevents movement of the same parallel to the joint space. This way complete stabilization of the facet joint is possible.

[0012] Pursuant to a preferred embodiment of the invention it can be provided that the at least one fixing element comprises surfaces that are oriented substantially parallel to the facet surfaces and can be inserted between the facet surfaces. This implant allows the joint space to be filled practically completely and be fixed such that the implant offers minimal working surfaces for torsion.

[0013] The at least one fixing element is preferably arranged on a substantially U-shaped clip, wherein the clip comprises two legs and one cross-member connecting the two legs. In addition to the fixing element, the implant therefore comprises a U-shaped clip, which additionally reinforces fixation of the facet joint.

[0014] Pursuant to another preferred embodiment of the invention it can be provided that the at least one fixing element is arranged on the cross-member. This way the implant can be attached to the facet joint in a particularly simple manner, specifically in that the clip is driven in, while simultaneously fixing the fixing element to the facets.

[0015] Beneficially the at least one fixing element is arranged on at least one of the two legs.

[0016] In this configuration as well the fixing element is fixed to the facet joint in conjunction with the clip.

[0017] It is beneficial when the at least one fixing element is arranged substantially parallel to a plane on the clip defined by the legs and the cross-member. When the clip is inserted to overlap the joint space, the fixing element is automatically inserted transversely to the joint space, wherein due to the clip also movement of the facet joint in a direction that is transverse to the joint space is prevented.

[0018] Furthermore it is beneficial when the at least one fixing element is arranged substantially transversely to a plane on the clip defined by the legs and the cross-member. This way the fixing clip can be inserted easily into the joint space, wherein the clip at the same time bridges the joint space and fixes the facets relative to each other.

[0019] It is especially favorable when at least one of the two legs comprises an impression that is arranged on a leg surface. This facilitates the insertion of the clips and in the implanted state creates a positive fit since the bone can remain in the impression. The latter counteracts loosening of the clips.

[0020] It is especially beneficial when the impression comprises a groove extending in the longitudinal direction of at least one of the two legs. When inserting the clip, the bone remains in the groove, thus forming a positive fit, which prevents loosening of the clip.

[0021] It is beneficial when the two legs have free ends and when on the free ends blades are provided. A clip

equipped this way with blades can be anchored especially securely in a bone since the blades penetrate the bone easily and prevent loosening of the clip.

[0022] In order to prevent detachment of the clips from the bone, anchoring elements projecting away in the direction of the facets are provided on at least one of the two legs.

[0023] The facet joint implant is especially stable when the cross-member and/or at least one of the two legs have a substantially rectangular cross-section.

[0024] For insertion of the implant it is beneficial if it comprises a tool retainer for connection with an insertion tool. The implant can be held by and inserted with such a tool, which corresponds to the tool retainer in any random fashion.

[0025] In principle the tool retainer can be arranged in any random area of the implant, preferably however it is arranged on the clip. This design enables particularly easy and secure insertion of the implant comprising a clip.

[0026] In order to enable especially simple handling of the implant, the tool retainer comprises at least one angled projection pointing away from the implant.

[0027] The first and second surfaces, which are in contact with at least one facet, of the at least one fixing element preferably have a concavely arched shape in the direction of the allocated facet surface. This way the joint space is filled in optimally and at the same time also movements parallel to the joint space are minimized, especially also when only a single fixing element is provided.

[0028] The at least one fixing element can be produced especially easily when it comprises a plane-parallel plate.

[0029] It is furthermore beneficial that at least one fixing element has a wedge shape. This offers additional stabilization for the facet joint.

[0030] The at least one fixing element preferably has a conical or multiple conical design. This accomplishes additional fixation of the implant in the area of the joint space.

[0031] It is especially beneficial when the at least one fixing element has an arch that is adapted to at least one of the two facets. A fixing element shaped this way can embrace one of the two facets at least partially and thus increase a contact surface on one of the two facets, which in the end leads to a stabilization of the joint.

[0032] In another preferred embodiment of the invention it can be provided that on the at least one fixing element anchoring elements projecting away in the direction of the facets are provided. The anchoring elements additionally establish connections between the implant and the bone parts, in turn stabilizing the joint.

[0033] The anchoring elements are preferably designed in the form of blades, teeth or ribs. These can be produced easily and lead to an optimal connection between the implant and the bone segments.

[0034] Pursuant to another preferred embodiment of the invention, it can be provided that the at least one fixing element carries two ribs projecting laterally substantially transversely to a plane defined by the at least one fixing element. Especially when the fixing element is being inserted in the joint space and fills it in, the laterally projecting ribs penetrate adjoining bone parts and fix the implant additionally in the joint space.

[0035] In order to enable bones to grow through the implant, the at least one fixing element can be equipped with passages.

[0036] In another preferred embodiment of the invention at least one fastening element retainer can be provided on the implant. Such an implant can be fixed on the facet joint using additional fastening elements, for example with screws, nails, clips or the like penetrating the fastening element retainer.

[0037] On the implant preferably at least one stabilizing stop is provided to stabilize the fixing element in the joint space. This way it is prevented that the implant penetrates the joint space too far or can work its way out of there.

[0038] It is beneficial when the stabilizing stop comprises two projections, which are arranged on end faces of the fixing element, projecting in the same direction. This way for example one of the two facets can be embraced on both sides by the fixing element with the two projections, which has a stabilizing effect particularly when the fixing element is inserted and fills out the joint space.

[0039] To increase stability and simplify production, the implant can have a single-piece design.

[0040] In order to favor the bones from growing to the implant, it can have a surface that is equipped with microstructuring and/or a bioactive coating.

[0041] The implant is made from X-ray transparent material. This way the implant is invisible when x-raying the human body and does not prevent the view of adjoining bone parts.

[0042] It is especially favorable when the implant is made from TiA16V4 or NiTiNol.

[0043] The following description of preferred embodiments of the invention serves the better explanation in conjunction with the drawing. Shown are:

[0044] Fig. 1 a side view of a first embodiment of an implant inserted in a joint space;

[0045] Fig. 2 a view along line 2-2 in Fig. 1;

[0046] Fig. 3 a view similar to Fig. 1 of a second embodiment of an implant;

[0047] Fig. 4 a view along line 4-4 in Fig. 3;

[0048] Fig. 5 a view similar to Fig. 1 of a third embodiment of an implant;

[0049] Fig. 6 a view along line 6-6 in Fig. 5;

[0050] Fig. 7 a view similar to Fig. 1 of a fourth embodiment of an implant;

[0051] Fig. 8 a view along line 8-8 in Fig. 7;

[0052] Fig. 9 a view of the implant in the direction of arrow A in Fig. 8;

[0053] Fig. 10 a view similar to Fig. 9 of a fifth embodiment of an implant;

[0054] Fig. 11 a view similar to Fig. 8 of a sixth and seventh embodiment of an implant;

[0055] Fig. 12 a cross-sectional view along line 12-12 in Fig. 11;

[0056] Fig. 13 a view similar to Fig. 4 of an eighth embodiment of an implant; and

[0057] Fig. 14 a cross-sectional view along line 14-14 in Fig. 13.

[0058] Figs. 1 and 2 illustrate an implant for facet joint arthrodesis, which has been given the overall reference number 100 and is inserted in a joint space 110 of a facet joint 112, which is formed by an osseous joint process of a vertebral body 120 projecting away in the direction of an adjoining vertebral body 114 and forming a first facet 116 as well as by an osseous process of the vertebral body 114 pointing to the vertebral body 120 and forming a second facet 118.

[0059] The joint space 110 of the facet joint 112 extends roughly parallel to a vertebral column of a human body defining a longitudinal direction and comprising the vertebral bodies 114 and 120.

[0060] To fix the facet joint 112, the implant 100 is inserted in the joint space 110. It comprises a base body 130 designed as a fixing element, which is formed basically by a rectangular, slightly wedge-shaped plate, having an arched shape across roughly half its width in the direction of its thinner end from a cross-sectional point of view. In the cross-section, as illustrated in Fig. 2, the shape of the base body 130 is reminiscent of the letter J. A bore 132, which serves the accommodation of a fastening element in the form of a bone nail 134, is arranged roughly centrally on the base body 130.

[0061] Parallel projecting tabs 140 and 141 are arranged transversely to the base body 130 and flush with the front edges 136 and 137 of the base body 130 and extend away from a concavely arched surface 144.

[0062] The implant 100 is used to fix the facet joint 112 by inserting the base body 130 into the joint space 110 so that it fills it in nearly completely and embraces the second facet 118 partially due to its arched shape. In the inserted state the two tabs 140 and 141 rest laterally against the first facet 116 and delimit it. When the implant 100 has assumed its final position, the bone nail 134 is pushed through the bore 132 and driven into the second facet 118.

[0063] Another implant 200 is illustrated in Figs. 3 and 4. It comprises a base body 230, which corresponds to the base body 130 of the implant 100. However, no lateral tabs 140 and 141 are provided, but instead a boundary plate 250, which is arranged transversely to the base body 230 on the longitudinal edge not adjoining the arched area and which has a convexly arched shape pointing away from the longitudinal edge 246.

[0064] It is arranged such that two lateral fastening tabs are formed, which are equipped with a bore 232 or 233, respectively. The implant 200 is fixed on the first facet 216 and the second facet 218 with two bone nails 234 and 235, respectively, when the base body 230 has been inserted in the joint space 210.

[0065] A third embodiment of an inventive implant has been given the overall reference number 300 in Figs. 5 and 6. It comprises a wedge-shaped, not arched base body 330, on which a boundary plate 350 is arranged in analog fashion to the implant 200. Instead of the bores 232 and 233, on the boundary plate 350 two mandrels 352 and 353 projecting away in the direction of the first facet 316 and the second facet 318 are arranged, specifically on a surface 355 of the boundary plate 350, which is arched in a concave fashion in the direction of the joint space 310. The mandrels 352 and 353 have a cylindrical shape in the area of the boundary plate 350 and are tapered in a cone shape towards their free ends.

[0066] The implant 300 is inserted in the joint space 310 by inserting the base body 330 into the joint space 310 and driving the mandrels 352 and 353 into the first facet 316 or the second facet 318.

[0067] Due to the arched shape of the boundary plate 350 the mandrels 352 and 353 do not project away from the boundary plate 350 in a parallel fashion so that they form a clip-like fixation of the facet joint 312 when they are driven in.

[0068] Figs. 7 to 9 show a fourth embodiment of an implant, which has been given the overall reference number 400. It is the simplest form of a facet joint implant for arthrodesis and consists in essence of a single fixing element forming a base body 430. The base body 430 comprises essentially a cuboid plate, the two largest lateral surfaces 458 and 459 of which extending in the longitudinal direction have a concave arched shape in relation to a direction that is transverse to the longitudinal direction 460 so that the base body 430 roughly has a dog-bone shape in the longitudinal section.

[0069] To fix the facet joint 412, the implant 400 is inserted in the joint space 410, specifically such that the concavely arched lateral surfaces 458 and 459 rest against the surfaces of the first facet 416 and the second facet 418, respectively, which have a slightly convexly arched shape.

[0070] The implant 400 can additionally be equipped with cross-holes 464, which are arranged transversely to the longitudinal direction 460 and penetrate the concave lateral surfaces 458 and 459, and which enable bones to grow through or alternatively fastening elements such as nails or screws to be accommodated.

[0071] An implant similar to the implant 400 has been given the reference number 500 in Fig. 10. On the base body 530, which is shaped analog to the base body 430, two symmetrically arranged fixing plates 566 and 567, which project away from the concave lateral surfaces 558 and 559 transversely to the longitudinal direction 560, are arranged, which extend across the entire width of the base body 530 and a common plane. In a direction transverse to the longitudinal direction 560, the fixing plates each have a width of one third the extension of the base body 530 in the longitudinal direction 560.

[0072] The implant 500 is inserted in the joint space 510 by inserting it and driving the fixing plates 566 and 567 into the first facet 516 and the second facet 518. This way the implant 500 is secured in the two facets 516 or 518 by means of the fixing plates 566 and 567.

[0073] Fig. 11 illustrates an implant, which has been given the overall reference number 600 and comprises two fixing plates 666 and 667 formed as fixing elements. These are arranged on a substantially U-shaped clip 670, respectively, specifically on its legs 672 and 673 extending substantially parallel to each other, wherein the leg 673 has only about two thirds the length of leg 672. The fixing plates are attached in a direction facing each other, pointing away from the legs 672 and 673, and extend parallel to a plane defined by the legs 672 and 673 as well as cross-member 674 that connects them and is arched away from them in a convex shape.

[0074] The legs 672 and 673 and the cross-member 674 have a substantially rectangular cross-section. The legs 672 and 673 are equipped with projections 676 and 677, which project in the direction of the other leg and form

an anchoring element, respectively. Furthermore the free ends 678 and 679 are chamfered, thus forming a blade. The legs 672 and 673 are furthermore equipped with a longitudinal groove 680 and 681 on their exterior surfaces so that the longitudinal grooves 680 and 681 open up away from each other.

[0075] The legs 672 and 673 are extended beyond the cross-member 674 and equipped with angled, retaining projections 882 or 883 pointing in the direction of the other one, which an insertion tool, which is not illustrated, can seize so as to insert the implant 600.

[0076] In order to fix the facet joint 612, the implant 600 is inserted such that it overlaps the joint space 610 by driving a leg 672 or 673 into the first facet 616 or the second facet 618, respectively. The two fixing plates 666 and 667 are then oriented such that they extend transversely to the joint space 610.

[0077] An alternative embodiment of the implant 600 has been given the overall reference number 700 in Figs. 11 and 12. This seventh embodiment comprises a clip 770, which is substantially identical to the clip 670 described in connection with the implant 600, however it comprises no fixing plates 666 or 667. Rather a fixing plate 785 resembling the base body 430 of the implant 400 is arranged on the cross-member 774 parallel to the legs 772 and 773 pointing in the direction of their free ends 778 and 779. The thickness of the fixing plate 785 corresponds maximally to the thickness of the clip 770. Additionally the fixing plate 785 is located in the plane defined by the clip 770.

[0078] In principle the implant 700 is inserted analog to the implant 600 in order to fix the facet joint 712. However it differs in the type of fixation in that the fixing plate 785 partially penetrates the first facet 716 transversely to the joint space 710 while bridging it and partially the second facet 718.

[0079] An eighth and last embodiment is illustrated in Figs. 13 and 14. It comprises all the features of the implant 700, however differs from it in the arrangement of the fixing plate 885. Contrary to the implant 700, said plate is arranged transversely to a plane on the cross-member 874 defined by the clip 870.

[0080] When the implant 800 is inserted in the joint space 810, the fixing plate 885 fills in the joint space 810 at least partially, and the legs 872 and 873 of the clip 870 fix the fixing plate 885 when they are driven into one of the two facets 816 or 818, respectively.

[0081] All implants 100 to 800 can comprise a surface containing micro-structuring and/or a bioactive coating. They can be made from an x-ray transparent material or also from TiA16V4 or NiTiNol.

[0082] Furthermore all implants 100 to 800 are designed as single pieces.

Patent Claims

1. Facet joint implant for the arthrodesis of a facet joint comprising a joint space and two facets, wherein the two facets contain facet surfaces facing the other face surface, respectively, comprising at least one fixing element, **characterized in that** the at least one fixing element (130; 230; 330; 430; 530; 666, 667; 785; 885) comprises a first and a second surface (144, 145; 244, 245; 344, 345; 458, 459; 558, 559; 658, 659; 758, 759; 858, 859) and that the first and the second surfaces (144, 145; 244, 245; 344, 345; 458, 459; 558, 559; 658, 659; 758, 759; 858, 859) can be brought into areal contact with at least one facet (116, 118; 216, 218; 316, 318; 416, 418; 516, 518; 616, 618; 716, 718; 816, 818).

2. Implant pursuant to claim 1, characterized in that two fixing elements (530, 566, 567) are provided and that one (566, 567) of the two fixing elements (530, 566, 567) penetrates the other fixing element (530) in a transverse direction.

3. Implant pursuant to claim 1 or 2, characterized in that the at least one fixing element (130; 230; 330; 430; 530; 885) comprises surfaces (144, 145; 244, 245; 344, 345; 458, 459; 558, 559, 858, 859) oriented substantially parallel to the facet surfaces and can be inserted between the facet surfaces.

4. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (666, 667; 785; 885) is arranged on a substantially U-shaped clip (670; 770; 870) and that the clip (670; 770; 870) comprises two legs (672, 673; 772, 773; 872, 873) and a cross-member (674; 774, 874) connecting the two legs (672, 673; 772, 773; 872, 873).

5. Implant pursuant to claim 4, characterized in that the at least one fixing element (785; 885) is arranged on the cross-member (774; 874).

6. Implant pursuant to one of the claims 4 or 5, characterized in that the at least one fixing element (666, 667) is arranged on at least one of the two legs (672, 673).

7. Implant pursuant to one of the claims 4 through 6, characterized in that the at least one fixing element (666, 667; 785) is arranged substantially parallel to a plane on the clip (670; 770) defined by the legs (672, 673; 772, 773) and the cross-member (674; 774).

8. Implant pursuant to one of the claims 4 through 7, characterized in that the at least one fixing element (885) is arranged substantially transversely to a plane on the clip (870) defined by the legs (872, 873) and the cross-member (874).

9. Implant pursuant to one of the claims 4 through 8, characterized in that at least one of the two legs (672, 673; 772, 773; 872, 873) comprises an impression (680, 681; 780, 781; 880, 881) arranged in a leg surface.

10. Implant pursuant to claim 9, characterized in that the impression comprises a groove (680, 681; 780, 781; 880, 881) extending in the longitudinal direction of at least one of the two legs (672, 673; 772, 773; 872, 873).

11. Implant pursuant to one of the claims 4 through 10, characterized in that the two legs (672, 673; 772, 773; 872, 873) comprise free ends (678, 679; 778, 779; 878, 879) and that on the free ends (678, 679; 778, 779; 878, 879) blades are provided.

12. Implant pursuant to one of the claims 4 through 11, characterized in that on at least one of the two legs (672, 673; 772, 773; 872, 873) anchoring elements (676, 677; 776, 777; 876, 877) projecting away in the direction of the facets (616, 618; 716, 718; 816, 818) are provided.

13. Implant pursuant to one of the claims 4 through 12, characterized in that the cross-member (674; 774; 874) and/or at least one of the two legs (672, 673; 772, 773; 872, 873) have a substantially rectangular cross-section.
14. Implant pursuant to one of the above claims, characterized in that the implant (600; 700; 800) comprises a tool retainer (682, 683; 782, 783; 882, 883) for connection to an insertion tool.
15. Implant pursuant to claim 14 and one of the claims 4 through 13, characterized in that the tool retainer (682, 683; 782, 783; 882, 883) is arranged on the clip (670; 770; 870).
16. Implant pursuant to one of the claims 14 or 15, characterized in that the tool retainer comprises at least one angled projection (682, 683; 782, 783; 882, 883) pointing away from the implant (600; 700; 800).
17. Implant pursuant to one of the above claims, characterized in that the first and the second surfaces (458, 459; 558, 559; 858, 859) of the at least one fixing element (430; 530; 885) in contact with at least one facet (416, 418; 516, 518; 816, 818) have a concavely arched shape in the direction of the allocated facet surface.
18. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (566, 567; 666, 667; 785) comprises a plane-parallel plate.
19. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (130; 230; 330) has a wedge shape.
20. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (130; 230; 330) has a conical or multiple conical design.
21. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (130; 230; 430; 530; 885) has an arched shape that is adapted to at least one of the two facets (118; 218; 416, 418; 516, 518; 816, 818).
22. Implant pursuant to one of the above claims, characterized in that anchoring elements (352, 353; 566, 567; 672, 673; 772, 773; 872, 873) projecting away in the direction of the facets are provided on the implant (300; 500; 600; 700; 800).
23. Implant pursuant to claim 22, characterized in that the anchoring elements are designed as blades (672, 673; 772, 773; 872, 873), teeth (352, 353) or ribs (566, 567).
24. Implant pursuant to claim 23, characterized in that the at least one fixing element (130; 530) carries two ribs (140, 141; 566, 567) projecting laterally substantially transversely from a plane defined by the at least one fixing element (130; 530).
25. Implant pursuant to one of the above claims, characterized in that the at least one fixing element (130; 230; 430) is equipped with passages (132; 232, 233; 464).
26. Implant pursuant to one of the above claims, characterized in that at least one fastening element retainer (132; 232, 233; 464) is provided on the implant (100; 200; 400).
27. Implant pursuant to one of the above claims, characterized in that at least one stabilizing stop (140, 141; 250; 350; 566, 567; 674; 774; 874) is provided on the implant (100; 200; 300; 500; 600; 700; 800) for the purpose of stabilizing the fixing element (130; 230; 330; 530; 666, 667; 785; 885) in the space joint.
28. Implant pursuant to claim 27, characterized in that the stabilizing stop comprises two projections (140, 141), which are arranged on end faces (136, 137) of the fixing element (130) and project in the same direction.
29. Implant pursuant to one of the above claims, characterized in that the implant (100; 200; 300; 400; 500; 600; 700; 800) has a single-piece design.
30. Implant pursuant to one of the above claims, characterized in that the implant (100; 200; 300; 400; 500; 600; 700; 800) has a surface containing a microstructuring and/or a bioactive coating.
31. Implant pursuant to one of the above claims, characterized in that the implant (100; 200; 300; 400; 500; 600; 700; 800) is made from x-ray transparent material.
32. Implant pursuant to one of the above claims, characterized in that the implant (100; 200; 300; 400; 500; 600; 700; 800) is made from TiA16V4 or NiTiNol.

---

4 pages of drawings

Number: DE 101 35 771 A1
Int. Cl.[7]: A 61 B 17/70
Disclosure Date: February 20, 2003

FIG.1

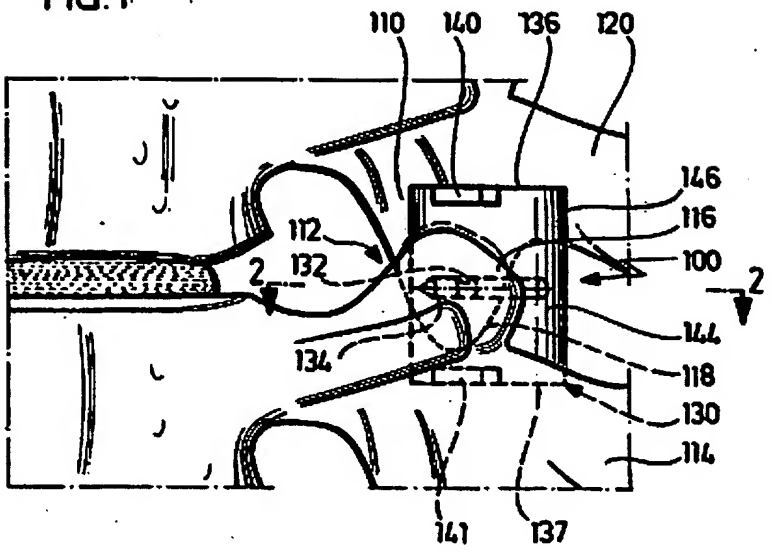
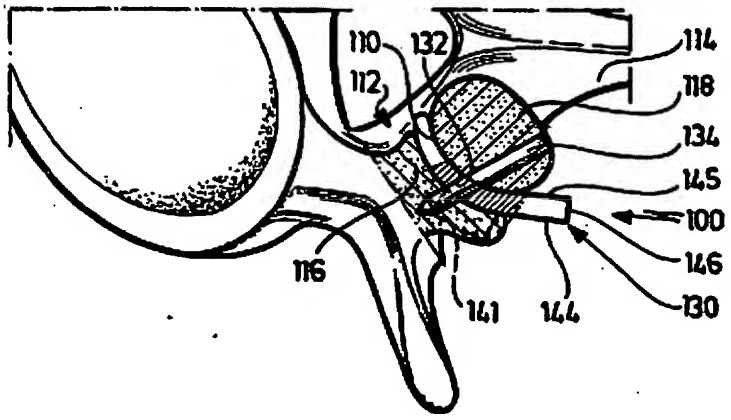


FIG.2



Number: DE 101 35 771 A1
Int. Cl.[7]: A 61 B 17/70
Disclosure Date: February 20, 2003

FIG.3

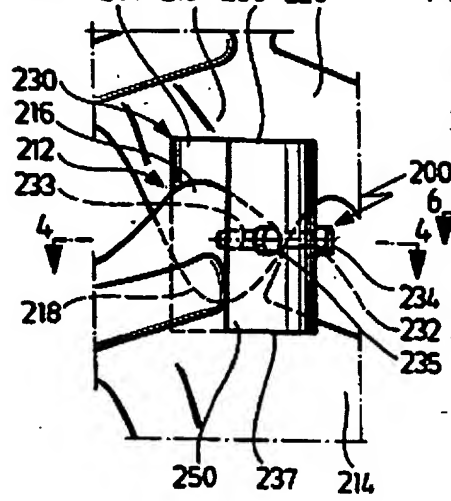


FIG.5

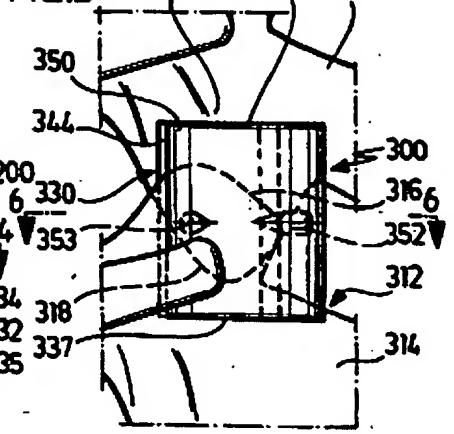


FIG.4

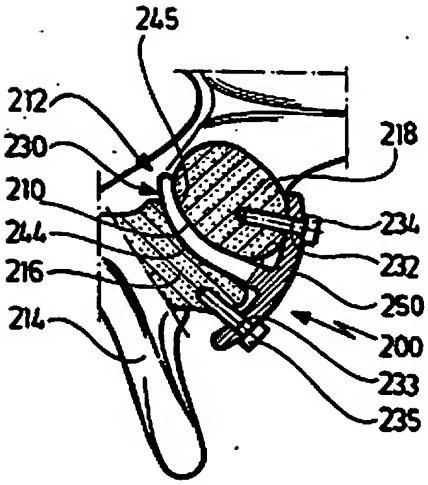
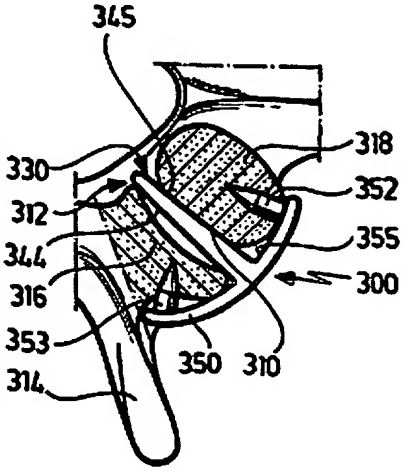


FIG.6



Number: DE 101 35 771 A1
Int. Cl.[7]: A 61 B 17/70
Disclosure Date: February 20, 2003

FIG.7

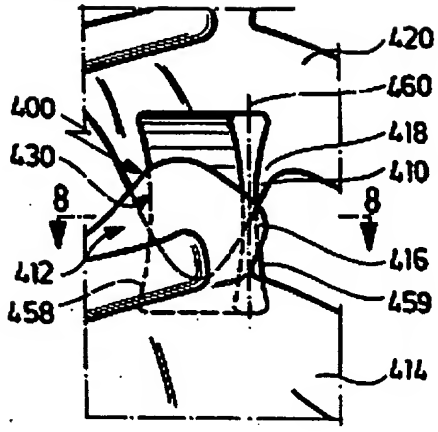


FIG.9

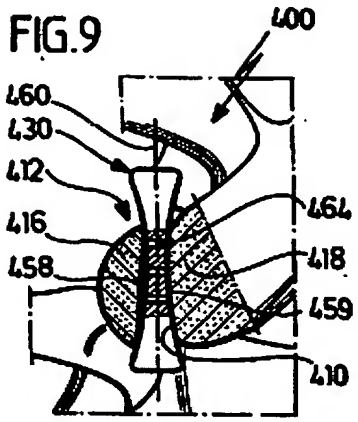


FIG.8

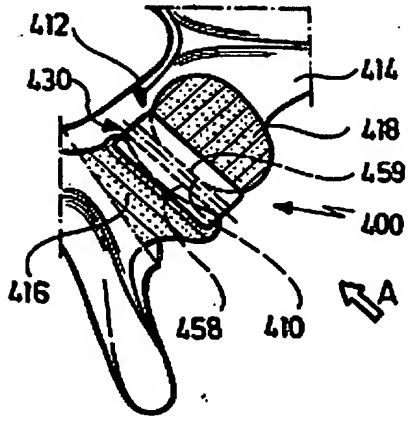
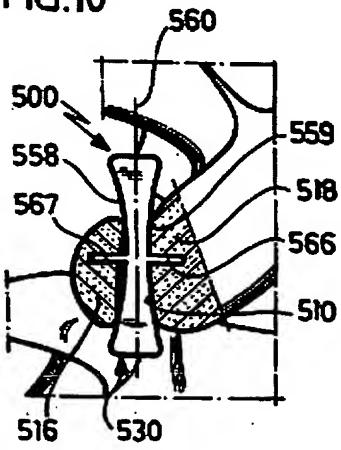


FIG.10



Number: DE 101 35 771 A1
Int. Cl.[7]: A 61 B 17/70
Disclosure Date: February 20, 2003

FIG.11

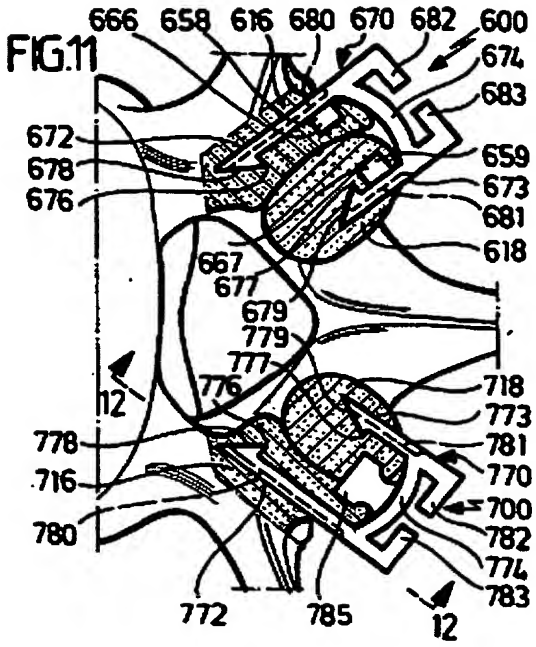


FIG.12

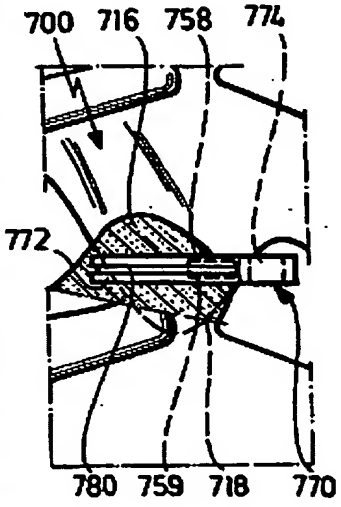


FIG.13

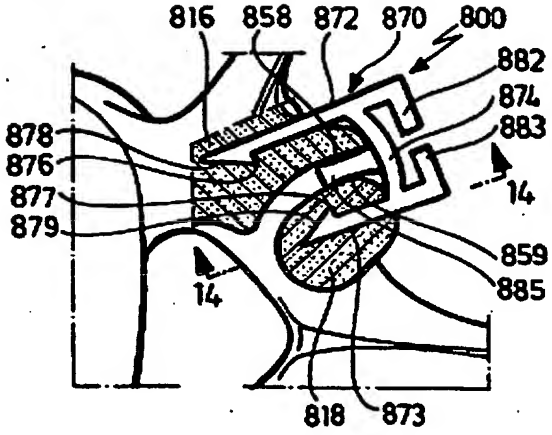


FIG.14